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Hosting services-linking the information warehouse information consumer

Freeman, B. Lidor, G.
AT&T Bell Labs., Holmdel, NJ, USA ;

This paper appears in: **Compcon Spring '94, Digest of Papers.**

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Publication Date: 28 Feb.-4 March 1994
Location: San Francisco, CA USA
On page(s): 165 - 171
Reference Cited: 0
Inspec Accession Number: 4653439

Abstract:
The warehouse and highway analogies of the information infrastructure addre storage and transport of information. To create information services for end-u infrastructure needs to address also the "retail" functions of ubiquitous availal customer support, billing, advertising, and packaging the information in an ea form, accessible to the information consumers. This paper describes the conc functions of hosting services, designed to address these "retail" functions and gaps between the raw information "mine", the information warehouse, and th information consumer

Index Terms:
advertising data communication systems information services invoicing advertising customer support data storage data transport end user information services hostinc information consumers information highway information infrastructure information pa information warehouse retail functions ubiquitous availability

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Data warehouse implementation considerations. (Technology Information)
Cipolla, Emil T.
Enterprise Systems Journal, v11, n6, p22(4)
June, 1996
ISSN: 1053-6566 LANGUAGE: English RECORD TYPE: Fulltext; Abstract
WORD COUNT: 2447 LINE COUNT: 00222

ABSTRACT: A plan to update an organization's data warehouse must begin with a clear assessment of the objectives of the data repository and a firm grasp of the relevant business objectives. Elements of data warehouse implementation include drawing data from a range of sources, managing and storing the data, providing access to the end-user, providing for multi-dimensional analysis of the data and providing attractive presentational options. A key issue is whether or not the relational database (RDBMS) will have to be replaced with a MultiDimensional DBMS system specifically designed for data warehouse applications. Most RDBMS systems are only able to accomplish On-Line Transactional Processing (OLTP) operations, while data warehousing requires On-Line Analytical Processing (OLAP). Users of a data warehouse can be categorized as power users, executive users and casual users. Guidelines for the selection of a commercial package include cost, function, performance level, scalability, open systems capability and vendor reliability.

TEXT:

When implementing a data warehouse project, you need to first define the objectives and decision criteria before evaluating the alternatives and developing the plan.

Your executives have read the articles in the business journals and are convinced that a data warehouse has the potential of significantly improving their competitive position, and they want one. You know that a data warehouse system is developed, not purchased "off the shelf." As a key member of the team assigned to plan and implement the data warehouse, you have many implementation questions. This article identifies the implementation considerations and discusses the decision criteria.

A data warehouse is the repository that contains all the data of potential interest to the firm. This purposefully broad definition suggests that almost all data may be stored, accessed, analyzed and presented by someone, sometime. It may contain current operational data summarized along several dimensions, historical data and metadata. There may be industrywide economic data or even unstructured data. Some firms manage pedabytes (10.sup.15) of data.

Data mining is the process used to analyze and summarize data from many perspectives to determine patterns so users can obtain relevant information necessary and appropriate to their questions.

Define Goals And Prioritize Objectives

As with any project, before you begin a data warehouse project there must be a clear description and agreement of the goals and objectives. Any information system should exist solely to support the firm's business objectives. Therefore, it is critical that management clearly define its near-term and long-term goals.

The obvious question is: What is the relative importance of these objectives? While management may indicate that all are equally important, project planners and developers need to know the tradeoffs and priorities.

Often, near-term objectives and priorities are different from long-term ones. The short-term objective may be to develop a successful pilot application using Rapid Application Development (RAD) techniques. This pilot project can then be used to demonstrate the benefits of a data warehouse and to learn from the pilot, refine the techniques and extend them to other functions and users.

There are five major elements involved in implementing a data warehouse:

1. Extract, transform and load the data warehouse from the various sources
2. Store and manage the data warehouse
3. End-user access
4. Data analysis from different perspectives
5. Presentation of the results.

When loading the data Warehouse, the source data usually must be "cleaned up," extracted, transformed and denormalized before it can be loaded into the data warehouse. The source data may be operational data and generation data sets in the RDBMS' format, hierarchical databases and flat files such as EBCDIC and ASCII files. The data warehouse may contain unstructured data in electronic mail, notes and trade journal articles as well as external data in public databases such as the Internet, Dun & Bradstreet files, Department of Commerce Statistics, etc. You can write programs to load the data warehouse or purchase one of many vendor products.

If the organization already has an RDBMS, a key question is whether the data in the data warehouse should be stored and managed by the same RDBMS or whether a MultiDimensional DBMS (MD-DBMS) specifically designed for data warehouse and dam mining should be used. The advantages of using the existing RDBMS include the fact that the staff is already familiar with it and the infrastructure and procedures are already in place. However, a key disadvantage is that these RDBMS products are designed for On-Line Transactional Processing (OLTP) and not for On-Line Analytical Processing (OLAP) of the data warehouse. An RDBMS generally can manage only structured data, and OLAP has significantly different characteristics from OLTP. OLAP systems must be able to process tens and even hundreds of gigabytes of data with reasonable and consistent performance and provide multiple views. Many contend that existing RDBMS products cannot effectively satisfy multidimensional OLAP requirements.

The advantages of using an MD-DBMS include the ability to more efficiently handle large data amounts through better data storage and indexing techniques. Some are specifically architected to exploit the power of Massively Parallel Processors (MPPs). The disadvantages include having to develop the infrastructure to learn, install and support another DBMS (manuals, education, training, etc.). You also may have another vendor, with the resulting interface complexities.

The access and presentation functions can be adequately satisfied by any number of excellent products with a GUI. Unfortunately, there are few such products available that execute on the mainframe; thus, many data warehouse systems are implemented in part on a PC or in a client/server environment.

Many data mining products perform the basic operations necessary for multidimensional OLAP summarization and analysis (slice and dice, consolidation, drill down and basic analysis). A few products provide statistical functions and even artificial intelligence capabilities for more sophisticated analysis.

User Classes And Requirements

One of the first considerations is to categorize users and determine

their requirements. One useful way is to group users into three broad categories on the basis of their different interests and requirements:

* Power users
* Executives
* Casual users.

When implementing a data warehouse, the challenge is to anticipate and satisfy the needs of these different users (see Table 1). Since many users may already be familiar with different end-user products, data mining tools should have interfaces to popular query and report writer products and spreadsheets, and provide exits to the available mathematical and statistical libraries. This imposes greater support requirements on the help desk.

Preferably, business professionals and/or executives should not require the assistance of an I/S professional. Users should be able to perform analysis in a manner consistent with their professions. For example, a financial analyst might use terms such as "calculate the yield to maturity," or "what is the internal rate of return"; an accountant might use terms such as "net profit," "earnings per share" or "pro-forma"; a sales manager might make a request to "compare the sales performance of each salesperson across all regions" or "compare the last 12 months of sales of the new product line with the sales of the original line," etc.

Evaluation Considerations

When selecting a data warehouse product or vendor, the planning team should develop evaluation and criteria weights before evaluating and selecting any product or vendor. These include:

* Economic
* Required function
* Usability
* Desired level of performance
* Scalability
* Openness
* Hardware/software platform environment:
* relative advantages of mainframes, client/server, PC
* use existing software or install new?
* Vendor considerations:
* best-of-breed components or single vendor?
* vendor viability and support (education, consulting).

A simple 1 to 5 evaluation scale is usually used. Identifying all the relative factors results in better accuracy, which is more important than precision. The criteria and weights should reflect your specific business environment and requirements. Any composite score should be used to indicate the relative, not absolute, evaluation.

An OLAP system is usually on a separate hardware system from the OLTP system, so it does not impact the operational and tactical needs of the organization.

An important consideration is to decide on the hardware and software platforms. The primary focus of this article is on products that execute either on an MPP or mainframe, or cooperate with a mainframe in a client/server environment. Of less interest are those products that execute only on stand-alone personal computers or Intelligent Work Stations (IWSes). Often, the extracted data and/or interim results are transferred to an IWS for subsequent analysis by the user.

Table 2 is a summary of the strengths of various hardware and software platforms. These considerations now will be "sliced and diced" and "drilled down."

Economic considerations should include the explicit hardware, software and network, support costs and benefits, and the hidden or intangible

costs. Many firms do not adequately consider the intangible economic costs, such as lost productivity, that occur when each user must act as a system administrator. Recent studies suggest that the total cost of a PC-centric or client/server system is much higher than initially thought. In some instances, it is five times greater than the cost of a mainframe-based system. The intangible benefits include the value of better, more timely information.

Price is a consideration, but more important is the relative value or ratio of achievable benefits to price. Users realize the importance of timely, useful information and are willing to pay for value received. The total cost of the hardware, prerequisite and OLAP software and the opportunity cost of late or inaccurate information should be included in the justification of the system.

Users should be provided with choices regarding the level of accuracy, desired precision, format of the query, statistical analysis techniques, level of sophistication of the model, resulting output and format. Examples include choices regarding graphical displays (line, bar, stack, pie, three-dimensional), colors and shading, equations, textual reports and spreadsheets.

Accuracy is not the same as precision; it is more important that users be provided with results that are accurate enough for the intended use than that they be extremely precise. For example, when preparing next year's budget, it is preferable that the manager know that the average salary is approximately $40,000 than to be told that it is $41,123.48, plus or minus $10,000.

Simplicity and intuitive end-user access and usability are key requirements for all users. Minimally, the products should provide a GUI with windows, menus, icons, tool bars, etc., and use nonprocedural SQL language.

Because the product may operate across multiple hardware/software platforms, the user interface should be consistent across all supported environments to minimize any education and retraining. Using the product should be intuitive and self-explanatory. There should be on-line, context-driven help that allows the user to obtain information and guidance regarding a topic by placing the cursor on the subject. By striking a key, a "pop-down" window appears with increasing levels of explanation of the topic. The user does not have to key in the subject; the system automatically provides information for the topic indicated by the cursor.

As with OLTP, the response time for OLAP depends on the hardware and software platforms, the nature of the analysis and the load on the system. The objective for OLAP can be several orders of magnitude longer than for OLTP. If the normal OLTP response time on a platform is n seconds, the following guidelines for the OLAP response time are proposed:

* Simple drill down and summarization -5 to 10n
* Statistical and regression analysis, mathematical analysis (e.g., curve fitting) - 10 to 50 n
* Artificial Intelligence (AI) - depending on the technique, this could take many minutes. In most instances, the AI tool will initiate a task to be executed in a batch partition. Scalability is the property that provides support for additional users, larger databases and higher performance by adding more computer resources (more storage capacity, processing power, terminals, etc.) without changing the fundamental operating environment, application or operating procedures. Doubling the power should allow doubling the number of users with no degradation in throughput or performance; doubling resources should provide the same number of users with twice the performance.

Scalability can be achieved vertically (adding resources to a single

processor) or horizontally (by enabling multiple processors to cooperatively operate and share the workload transparently). Typically, systems are scaled using:

* Larger uniprocessors
* Tightly coupled multiprocessors sharing memory and DASD
* A loosely coupled multiprocessor that may share DASD but have separate processors or main memory
* MPPs with hundreds of processors.

Openness is the ability to interface with other vendors' products and other hardware and software platforms. The data should be importable from and exportable to the popular word processing, database and spreadsheet products.

In a concurrent multiuser access and usability environment, data integrity, data security and privacy are critically important. The organization needs to balance usability and accessibility with the need to protect the fundamentally valuable corporate data asset against unauthorized access. Recent articles have discussed instances where businesses incurred billions of dollars in lost or damaged data because of inadequate data access security protection against malicious actions, fraud and computer viruses.

When building a data warehouse, you may select products from the same vendor (or from its business partners) or you may select "best-of-breed" products from several vendors and integrate them into a cohesive system. With the latter, you can be the systems integrator or rely on one of the many consulting firms that offer integration installation and turnkey services. If data mining system products are selected from multiple vendors, then they must be integrated to work together (not a trivial task).

The "staying power" and viability of a vendor is as important as the functional characteristics of the product. Recently, there have been numerous consolidations, restructuring and mergers in I/T. This has resulted in many software products being stabilized or no longer being marketed and supported. Many of the most innovative products are provided by smaller vendors. If you are to make the investment in data warehouse software and tools, you need assurance that the products will continue to be supported, enhanced and improved. This commitment is demonstrated by code quality, frequency of releases, the existence of user groups and the vendor's ability to provide technical, educational, installation and international service support. Other possible indicators include the vendor's level of sales and number of technical employees, years in business, sales offices, customer installations, etc.

Conclusion

When implementing a data warehouse project, you need to first define the objectives and decision criteria before evaluating the alternatives and developing the plan.

Table 1

Typical User Characteristics

characteristic	Power User	Executives
Level of Function	Sophisticated	Basic
Response Time	Medium	Quick
Processing Demand	High	Medium to Low
Usability Needs	Low	High
Accuracy	High	High
Precision	High	Medium to Low
Openness	High	Medium to Low
Analysis	Ad hoc, diverse detailed	Summary,strategic, some detail

characteristic	Casual Users
Level of Function	Basic
Response Time	Medium to Low
Processing Demand	Low
Usability Needs	Medium
Accuracy	High
Precision	High
Openness	Medium to Low
Analysis	Basic, preplanned

Table 2

Summary Of Relative Strengths Of Hardware/Software Platforms

	MPP	Mainframe	Client/Server	PC
Data Storage Capacity, I/O	High	High	Med	Low
Access-Usability	Low	Low	High	High
Presentation	Low	Low	High	High
I/S Services	High	High	Med	Low
# Users	Very High	High	Med	Low
Analysis	High	High	High	High
Scalability	High	High	Med	Low

MPP and mainframes provide better storage and I/O

PCs provide better access, usability and presentation

Emil T. Cipolla has more than 30 years of experience in developing large-scale mainframe information systems. He can be reached at 102127.2451@compuserve.com.

DESCRIPTORS: Technology Overview; Data Warehousing; OLAP; MIS; System Conversion
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* A loosely coupled multiprocessor that may share DASD but have separate processors or main memory
* MPPs with hundreds of processors.

Openness is the ability to interface with other vendors' products and other hardware and software platforms. The data should be importable from and exportable to the popular word processing, database and spreadsheet products.

In a concurrent multiuser access and usability environment, data integrity, data security and privacy are critically important. The organization needs to balance usability and accessibility with the need to protect the fundamentally valuable corporate data asset against unauthorized access. Recent articles have discussed instances where businesses incurred billions of dollars in lost or damaged data because of inadequate data access security protection against malicious actions, fraud and computer viruses.

When building a data warehouse, you may select products from the same vendor (or from its business partners) or you may select "best-of-breed" products from several vendors and integrate them into a cohesive system. With the latter, you can be the systems integrator or rely on one of the many consulting firms that offer integration installation and turnkey services. If data mining system products are selected from multiple vendors, then they must be integrated to work together (not a trivial task).

The "staying power" and viability of a vendor is as important as the functional characteristics of the product. Recently, there have been numerous consolidations, restructuring and mergers in I/T. This has resulted in many software products being stabilized or no longer being marketed and supported. Many of the most innovative products are provided by smaller vendors. If you are to make the investment in data warehouse software and tools, you need assurance that the products will continue to be supported, enhanced and improved. This commitment is demonstrated by code quality, frequency of releases, the existence of user groups and the vendor's ability to provide technical, educational, installation and international service support. Other possible indicators include the vendor's level of sales and number of technical employees, years in business, sales offices, customer installations, etc.

Conclusion

When implementing a data warehouse project, you need to first define the objectives and decision criteria before evaluating the alternatives and developing the plan.

Table 1

Typical User Characteristics

characteristic	Power User	Executives
Level of Function	Sophisticated	Basic
Response Time	Medium	Quick
Processing Demand	High	Medium to Low
Usability Needs	Low	High
Accuracy	High	High
Precision	High	Medium to Low
Openness	High	Medium to Low
Analysis	Ad hoc, diverse detailed	Summary,strategic, some detail

characteristic	Casual Users
Level of Function	Basic
Response Time	Medium to Low
Processing Demand	Low
Usability Needs	Medium
Accuracy	High
Precision	High
Openness	Medium to Low
Analysis	Basic, preplanned

Table 2
Summary Of Relative Strengths Of Hardware/Software Platforms

	MPP	Mainframe	Client/Server	PC
Data Storage Capacity, I/O	High	High	Med	Low
Access-Usability	Low	Low	High	High
Presentation	Low	Low	High	High
I/S Services	High	High	Med	Low
# Users	Very High	High	Med	Low
Analysis	High	High	High	High
Scalability	High	High	Med	Low

MPP and mainframes provide better storage and I/O
PCs provide better access, usability and presentation

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DESCRIPTORS: Technology Overview; Data Warehousing; OLAP; MIS; System Conversion
FILE SEGMENT: CD File 275

01925995 SUPPLIER NUMBER: 18199992 (THIS IS THE FULL TEXT)
Using sophisticated techniques in OLAP. (online analytical processing) (Technology Information)
Cipolla, Emil T.; Boden, Ed
Enterprise Systems Journal, v11, n4, p39(3)
April, 1996
ISSN: 1053-6566 LANGUAGE: English RECORD TYPE: Fulltext; Abstract
WORD COUNT: 2857 LINE COUNT: 00237

ABSTRACT: Online analytical processing systems deliver information for unexpected and unstructured situations. Analysis processing can involve simple or complex questions as well as required analysis from various angles. Data mining's analysis processing is multidimensional and performed on-the-fly. It allows different departments to gather small to large amounts of data in as honed a fashion as is desired. All OLAP and data mining tools are customizable by size and specificity for searches. OLAP and data mining products that transgress basic analytical capabilities move into the realm of mathematical and statistical routines for trend analysis or curve fitting. Knowledge-Based Systems-enabled (KBS) data mining tools can discover patterns in data that are otherwise not readily apparent. Some products display results in graphical format, others use scales or factors. Statistical techniques are most relevant when specific variables exist and their relationships are under investigation.

TEXT:

Many firms have available a vast amount of operational, historical and external data from industry or government sources. Increasingly, this data is stored in a data warehouse and managed and accessed differently from the operational system, Some firms stiffer from data overload. or too much data to effectively analyze. Techniques are being used to sift through this vast amount of data and determine the relevant information necessary to answer the questions at hand.

Operational systems provide answers to well-structured, predefined situations such as sales, inventory control. accounts receivable, accounts payable and general ledger systems. Batch and On-Line Transactional Processing (OLTP) programs are developed to satisfy these structured (although possibly complex) events.

Separate systems are necessary to enable you to answer situations that are not predefined, Unlike OLTP systems. On-Line Analytical Processing (OLAP) systems provide information for unstructured and unanticipated situations. Typically, an analyst reviews a large amount of current or historical data in an exploratory, unplanned or ad hoc manner to detect some pattern or trend.

There are many aspects of data mining and OLAP; this article focuses on the use of more sophisticated techniques in analysis processing.

Analysis Processing

The questions and the required analysis may be simple or complex and may be analyzed from many different perspectives. For example, a sales manager may analyze sales by customer, listing customers with the highest total amount of sales, the lowest. the average amount and the total sales by product line, time period, geographic region, etc:. A product manager may analyze the same data by product line, a com troller by time period, a regional manager by geography, a development manager by feature, etc.

Data mining is the process of analyzing this data from all these

perspectives in an act hoc, multidimensional manner. Data mining allows different individuals to retrieve as much or as little data as they need. They can retrieve current detail data, historical clam or even external tiara and summarize it by any desired category. All data mining and OLAP products provide a basic analysis capability (minimum, maximum, average) and the ability to drill down to obtain more detail anti summarize details as necessary.

Some data mining and OLAP products go beyond basic analysis capabilities anti provide statistical and mathematical routines to calculate the coefficients and powers of prespecified independent variables. This is known as curve fitting or trend analysis. Trend analysis is used to determine patterns and relationships, and if key measurements are still within limits and expectations.

It is not difficult to determine patterns when the variables are known. Mathematical techniques are available to determine the relationship of one dependent variable (such as sales of a particular model) to several independent variables (such as the selling price, competition, number of sales channels, sales of complementary products, inflation rate, etc.). The resulting mathematical expression may Ix: complex and have several independent terms with coefficients raised to different powers. Note that while the mathematics may be complex and require a large amount of system resources, the analyst must first specify the dependent and independent variables before the program can determine the coefficients and powers.

However, the difficulty is identifying key patterns and trends when the analyst does not know the independent variables or, for that matter, may not even know what dependent variable should be analyzed. This is where more sophisticated and powerful Knowledge-Based System (KBS) techniques can be useful.

Knowledge-Based Systems

A data mining product with KBS capabilities can detect patterns in data that are not readily apparent; that is, it can indicate that there is a relationship between one dependent variable and one or more independent variables. Some products utilize data visualization techniques to graphically present these relationships. The analyst can change the scale, display format and factors to better represent the relationships. The relationship need not be a causal one, nor is it most likely readily apparent.

For example, KBS can determine that when the July sales of chocolate ice cream in a supermarket with more than 50,000 square feet of space are more than 500 gallons, then the November sales of red wine in the adjacent specialty store will be more than 10 cases.

The key point is that statistical techniques are appropriate when the variables are specified by the analyst beforehand, and their relationship must be determined. However, the more sophisticated systems analyze the data not only to determine the relationship, but also to identify what are the relevant variables. These techniques first calculate the coefficients and variables and develop the rules and patterns. Then they may analyze additional data and modify the rules by changing the coefficients or even by adding or deleting independent variables without needing the analyst's judgment and intervention.

Some Knowledge-Based Techniques

Several KBS technologies are of interest. The technologies can be described as being either qualitative reasoning and model-based, quantitative analysis and rule-based, or from some other perspective.

Qualitative vs. Quantitative

Models are used in many data processing and data mining applications and often are imprecise. They purposefully simplify the assumptions, facts

and problem-solving process, hoping the results will still adequately represent the real world. The objective is to develop a model at the lowest cost that completely depicts the problem, is accurate and precise, but is easy to use. Ideally, the model is created from as small a sample as possible and can successfully and reliably predict new cases. Often, very adequate results are obtained through the use of relatively simple rules.

Model-based KBS systems explicitly state the fundamental dependent relationships among the variables. Model-based systems generate, test and evaluate the solution for consistency; feedback controls are used to constrain the acceptable solution. Heuristics (discussed later in this article) are used to terminate the search when it seems that the most likely alternatives have been identified and evaluated. Qualitative models are used for situations involving vague conditions, complicated interactions among the factors and inequalities. Qualitative models often provide a range of acceptable solutions and differing interpretations.

Quantitative methods are usually more specific and precise. KBS sones complex problems by applying facts and rules that mimic human reasoning. Facts express a truth concerning some entity. Rules are relationships among facts about certain situations. An example in programming is the IF ... THEN ... ELSE logic; that is, IF fact 'N' is true, THEN perform action 'X'; ELSE perform 'Y'.

The rules may be simple (as in the definition of profit being equal to income minus expense) or complex (as in the calculation of federal tax liability). Some rule-based systems screen the alternatives and courses of action, rank them and select the highest-scoring candidate. Often, rule-based models hide the underlying assumptions, do not allow for judgment and exceptions or are inflexible. They usually are impractical to code for all combinations and normally cannot handle subtleties.

Expert Systems

Expert systems use predefined logical "rules" to analyze a problem. Typically, application experts are interviewed to capture their problem-solving approaches. Their thoughts and decision-making processes are then codified into a set of rules that is applied to new situations. The relationships and rules for all steps are well-known and are methodically followed without modification. An example of an expert system is the creation of a sales invoice. The unit price is multiplied by the number of units, then the discounts and sales taxes are applied to arrive at the total cost.

An example of a rule is the shortest rule. Pruning is a technique of continually deleting components of the model and comparing the results to the previous results. If the pruned performance is equal to or better than that of the unpruned model, then the pruned model is used. An, equation may consist of several independent variables, each raised to a high-order power. You then reduce the number of variables and/or reduce the power until the result is no longer better than the previous result. The pruning technique is appropriate in many commercial and business applications.

These rules are usually employed in one of two ways.

* Forward chaining (or data-driven) -- This method starts with a set of initial facts and evaluates rules to generate new facts until the goal is achieved. For example, when developing a personal budget, you start with facts stating income and expenses. KBS applies the rules appropriate to the level of mandatory expenditures. These lead to new facts regarding categories of allowable expenditures for food, housing, transportation, etc. The result is a completed budget. Often, the KBS model does not have rules that cover all situations; note that there were no rules regarding the acceptable level of borrowing. This omission is usually handled in KBS systems by using heuristic techniques.

* Backward chaining (or goal-driven) -- This search method starts with a goal and continually evaluates rules to establish subgoals. In program debugging, the goal is to find and correct the cause of the error. If there is a compile error, you find and correct the cause and recompile the program. Where expert systems start with the rules and apply them to the data, other more sophisticated tools are able to analyze the data, derive and modify the rules and apply them to additional situations (e.g., "learn" from new data). These are called heuristic systems.

Heuristic Systems

Heuristics is a Greek term meaning to discover and be self-learning. In heuristics, there is a reasonable confidence that a series of steps will lead to a successful solution. The steps are followed and modified until the desired results are achieved. In programming, inductive systems begin with a proposed answer and then modify it as new facts are learned and evaluated. Program debugging, automobile and medical diagnosis, and detective work are often heuristic processes. Some heuristic technologies include the following.

* Fuzzy logic and probabilistic reasoning-techniques for writing rules that handle the vagueness and imprecision of many business concepts or partially true data (such as new vs. old, teenager vs. adult buying patterns, fast vs. slow, etc.). The rules may be either sophisticated or simple and can deal with subtleties.

* Nearest neighbor--an attempt is made to identify the existing subset of the clam population that most closely resembles the characteristics of the subset under evaluation. The closest neighbors share many similar attributes but are different enough to be in separate groups.

* Neural networks--a network of many simple processors (units). Each processor may have many inputs and outputs, and each performs a simple computation to produce the output. The computation may be different for each of the units. Neural networks are useful for the solution of pattern-recognition and data-filtering problems.

Scoring, Verification And Discovery

Another perspective is to categorize the KBS techniques as either scoring, verification or discovery.

In scoring, the attributes or characteristics of a finite number of subgroups are identified. Examples might be age, sex, marital status income, educational level, etc. Each attribute is assigned a numerical value. Then, each new instance is assigned to one of the subgroups by scoring the attributes. This technique works well for a small number of attributes but requires expert detailed knowledge of the model. Since it is knowledgeintensive and can be time-consuming, its use is usually limited to business professionals rather than executives.

In verification, the data is iteratively analyzed by issuing a series of simple queries. The interim results are sliced and diced repetitively until the desired level of accuracy, precision and usability is obtained (or you become exhausted!).

In discovery, rules are created concerning the data (this is essentially the KBS approach, in which the system evaluates the data characteristics).

Many of these technologies have been available in the research and academic environments for years; recently, comprehensive KBS development tools have become available to the commercial information processing arena. These tools, which are available in several hardware/software environments, have enabled leading-edge I/S organizations to develop KBS-based applications. The tools contain a rich set of built-in functions, editors and interfaces to external databases. Some of these applications use the building blocks available from vendors; others are internally developed by

companies for a unique application or to preserve their competitive edge.

Typical KBS Applications

Where are the most appropriate applications of KBS in OLAP and data mining? Typically, the solution involves judgment and a set of complex interrelated facts and rules, and the solution often need not be exact or unique.

Accounting data is analyzed beyond the traditional profit-and-loss and balance sheet reports to determine the contribution to net profits by product line, region or cost center. Product managers might set the desired profit objectives and then determine the required amount of Sales for different combinations of product line, brand, sales channel or region necessary to achieve these objectives.

In finance, expert systems are used to state the relationships between a fundamental financial instrument (such as a Treasury Bill) and financial derivatives to predict the changes in market valuation between them. In another example, an expert system is used to estimate the accuracy of financial statements; the model develops expectations regarding what the financial results should be. To the extent that these' expectations are not met, then further investigation (drilling down of the data) is performed. In addition, major banks use KBS to analyze the Financial markets and audit foreign exchange transactions.

Sales data is compared to past periods and to the sales of competitors. A typical question might be: "What was the impact of the increase in advertising on the level of sales of the product, and how does that compare to the level of sales resulting from last year's sales promotion campaign.

In marketing, the relevant market is segmented into homogeneous subgroups that share similar demographics (age, sex, ethnicity, marital status, etc.), geographic location or industry classification. The objective is to determine the factors that distinguish the buying patterns of the members of the subgroup from those in other subgroups.

Direct marketers analyze their databases to gain a Competitive marketing advantage. One firm has a database containing more than 100 million records of past customer purchases that they use to send targeted promotional offerings based on the customer's purchase history. They can design and execute precise marketing programs with predictable and measurable results.

Tobacco firms use a database of smokers' names and addresses to send coupons and free samples directly to consumers. The firms also can identify likely buyers of their products or send promotional offers to consumers of rival brands.

A major video rental firm uses its records of more than 40 million households to achieve several objectives. First, it can recommend movie rentals to individual customers based on past rentals; this results in improved service. Second, it can reduce its overall inventory level and costs by stocking only the most popular titles. The resulting cost savings can be passed on to customers through lower prices, or the firm can increase profits.

A major credit card firm prints targeted promotional offers next to the invoice lines on monthly statements. If the customer's invoices show a pattern of charges for airline trips to England, the billing statement may include a note of an upcoming sale at Harrod's department store in London. KBS is also used in credit card authorizations to evaluate margin credit accounts and in fraud detection

In I/S, many organizations use KBS technologies to help automate the help desk, diagnose system problems, improve database design and system capacity utilization and efficiency, and automate operations.

Conclusion

The preceding are only a few examples of how KBS technologies are used in OLAP and data mining to solve business problems.

It is the effective use of KBS technologies for the OLAP data analysis function that distinguishes the relatively few leading-edge data mining products from those that only offer data drilling, consolidation and slicing-and-dicing functions.

Emil T. Cipolla, M.S.M.E. and M.B.A., has more than 30 years of experience in developing lathe-scale mainframe information systems. He can be reached at 102127.2451@ compuserve. com.

Ed Boden is a development programmer with IBM with 15 years of experience. He has developed operating systems and networking and system management software on a variety of platforms. He can be reached at 102103.152@compuserve.com

DESCRIPTORS: OLAP; Technology Overview; Decision Support Software; Data Warehousing
FILE SEGMENT: CD File 275
?

L15: Entry 19 of 19 File: USPT Apr 16, 1996

DOCUMENT-IDENTIFIER: US 5508733 A
TITLE: Method and apparatus for selectively receiving and storing a plurality of video signals

Brief Summary Text (42):
Channel availability has been a crucial limitation in the broadcasting industry. Channel allocation has been very valuable and expensive. It has precluded several interested individuals, small businesses, consumers, and local community chapters from accessing the TV broadcasting networks, in order to express personal views or to advertise.

Brief Summary Text (79):
Four-tube (luminance-channel) cameras were then introduced when color receivers served a small fraction of the audience. The viewer of color program in monochrome became aware of lack of sharpness. Using a high-resolution luminance channel to provide the brightness component in conjunction with three chrominance channels for the Red (R), Green (G) and Blue (B) components produced images that were sharp and independent of registry errors.

Brief Summary Text (109):
Nowadays, small businesses and individuals find it quite prohibitive to advertise and/or to express their views in conventional publications, such as newspapers. As the cost of printed publications rises with the continuing decrease of natural resources, it will become even more forbidding for individuals and small businesses to retain, even the limited access to printed publications, they now enjoy. This problem will become a major concern in the near future, as it will very subtly become an indirect restraint on the constitutional freedom of speech.

Brief Summary Text (165):
51. U.S. Pat. No. 5,099,319, to Esch et al. generally discloses an apparatus having a central site and a remote site for customizing advertising for television using a video signal comprising a communication channel, and video and communications processors. The video processor mixes the first content data signal with the video signal. A cue processor generates insertion signals.

Brief Summary Text (168):
The Esch et al. U.S. Pat. No. 5,099,319 generally describes a video information delivery apparatus for customizing advertising for television. As exemplified by claim 2, the apparatus includes a studio processor and storage, for generating and storing content data signals. A schedule-processor is responsive to the content data signals for generating a schedule data signal. A network processor generates ac communications data signal, and a transmitter transmits the communications signal. A control processor coordinates the operation of the studio-processor, schedule-processor and network processor.

Detailed Description Text (305):
Cable television systems in the United States carry an average of 35 channels of diversified programming services. Higher capacity systems are currently being

designed to 80 channels (550 MHz) on a single coaxial cable. Commercial program insertion systems, such as spot advertising, cross-channel promotional, barker insertions and network non-duplication have evolved somewhat independently in cable systems, and it would be desirable to integrate these program insertion systems within the cable television network.

Detailed Description Text (309):
The VAD mapping system could also be used by the advertising agencies to reserve their spots, similarly to the reservation network used by travel agents.

Detailed Description Text (320):
The multiplexed signals could be stored in storage 243 for several purposes, such as for later transmission to the end users or to other stations, according to an established schedule.

Detailed Description Text (333):
The transmission station 204A includes a computer 53 which is the central control unit for the signal samplers 206, 208, 210; the compressors 216, 218, 220; the multiplexer 222; the storage unit 242; and the selectors 275 and 275A. In the preferred embodiment, the selector 275 is used to control the multiplexing and transmission of selected channels, while the selector 275A is used to control the initial reception of incoming channels (1 through n). Thus, if the computer 53, determines that only a certain number of channels (i.e. 1 and 2) have been selected, via the selectors 275 and 275A, then it can either disable the operation of the non functional samplers (i.e. 210); or, in the alternative, it could use them to assist in alleviating the traffic on congested circuits. In this manner, the operation of the transmission station 204A is optimized.

Detailed Description Text (372):
The present invention can also be used in video-audio-data mail applications, where a sender of information can leave encoded video, audio and/or data (VAD) messages, on a recorder, such as a conventional video recorder. When these VAD messages are to be retrieved, they are demultiplexed, demodulated and decoded according to the above teachings. The present video modulation system has several military applications in that it allows the encoding of video, audio and data signals in a non-decodable format by unauthorized users.

Current US Original Classification (1):
725/93

Current US Cross Reference Classification (3):
725/100

Current US Cross Reference Classification (4):
725/116

Current US Cross Reference Classification (5):
725/131

Current US Cross Reference Classification (6):
725/32

2/3,K/1 (Item 1 from file: 65)
DIALOG(R)File 65:Inside Conferences

03486189 INSIDE CONFERENCE ITEM ID: CN036756974
Pest control experiences in a territory infested by Aedes albopictus
Renzulli, G.; **Cipolla, E.** ; Baseggio, A.
CONFERENCE: Societa Italiana di Parassitologia; La parassitologia oltre il 2000-Congresso; 21
PARASSITOLOGIA, 2000; VOL 42; SUPPL 1 P: 32
Universita di Roma "La Sapienza", 2000
ISSN: 0048-2951
LANGUAGE: English DOCUMENT TYPE: Conference Abstracts
CONFERENCE SPONSOR: Societa Italiana di Parassitologia
CONFERENCE LOCATION: Padua, Italy
CONFERENCE DATE: Jun 2000
NOTE:
Text in English or Italian

Renzulli, G.; **Cipolla, E.** ; Baseggio, A.

2/3,K/2 (Item 2 from file: 65)
DIALOG(R)File 65:Inside Conferences

01413281 INSIDE CONFERENCE ITEM ID: CN014022888
Sinecologia e selezione d'habitat di passeriformi svernanti in ambient mediterranei: un caso di studio tramite mist-net
Mingozzi, T.; Cortone, G.; **Cipolla, E.** ; Garofalo, G. P.
CONFERENCE: Convegno Italiano ornitologia-8 (8 Convegno Italiano ornitologia; Ottavo Convegno Italiano ornitologia)
AVOCETTA -PARMA-, 1995; VOL 19; NUMBER 1 P: 91
CISO, 1995
ISSN: 0404-4266
LANGUAGE: Italian DOCUMENT TYPE: Conference Papers
CONFERENCE EDITOR(S): Fasola, M.; Saino, N. 1995 (199500) (199500)

Mingozzi, T.; Cortone, G.; **Cipolla, E.** ; Garofalo, G. P.

2/3,K/3 (Item 1 from file: 2)
DIALOG(R)File 2:INSPEC

04237339 INSPEC Abstract Number: C9210-5260B-104
Title: Qualitative surface shape from deformation of image curves
Author(s): **Cipolla, E.** ; Zisserman, A.
Author Affiliation: Dept. of Eng. Sci., Oxford Univ., UK
Journal: International Journal of Computer Vision vol.8, no.1 p. 53-69
Publication Date: July 1992 Country of Publication: Netherlands
CODEN: IJCVEQ ISSN: 0920-5691
Language: English
Subfile: C

Author(s): **Cipolla, E.** ; Zisserman, A.

1/3,K/1 (Item 1 from file: 275)
DIALOG(R)File 275:Gale Group Computer DB(TM)

01961300 SUPPLIER NUMBER: 18467372 (USE FORMAT 7 OR 9 FOR FULL TEXT)
Data warehouse implementation considerations. (Technology Information)
Cipolla, Emil T.
Enterprise Systems Journal, v11, n6, p22(4)
June, 1996
ISSN: 1053-6566 LANGUAGE: English RECORD TYPE: Fulltext; Abstract
WORD COUNT: 2447 LINE COUNT: 00222

Cipolla, Emil T.

1/3,K/2 (Item 2 from file: 275)
DIALOG(R)File 275:Gale Group Computer DB(TM)

01925995 SUPPLIER NUMBER: 18199992 (USE FORMAT 7 OR 9 FOR FULL TEXT)
Using sophisticated techniques in OLAP. (online analytical processing) (Technology Information)
Cipolla, Emil T. ; Boden, Ed
Enterprise Systems Journal, v11, n4, p39(3)
April, 1996
ISSN: 1053-6566 LANGUAGE: English RECORD TYPE: Fulltext; Abstract
WORD COUNT: 2857 LINE COUNT: 00237

Cipolla, Emil T ...

1/3,K/3 (Item 3 from file: 275)
DIALOG(R)File 275:Gale Group Computer DB(TM)

01893287 SUPPLIER NUMBER: 17813803 (USE FORMAT 7 OR 9 FOR FULL TEXT)
Data mining: techniques to gain insight into your data. (Technology Information)
Cipolla, Emil T.
Enterprise Systems Journal, v10, n13, p18(5)
Dec, 1995
ISSN: 1053-6566 LANGUAGE: English RECORD TYPE: Fulltext; Abstract
WORD COUNT: 2796 LINE COUNT: 00246

Cipolla, Emil T.
?

2/3,K/4 (Item 1 from file: 144)
DIALOG(R)File 144:Pascal

02362358 PASCAL No.: 79-0437231
LA COLANGIOGRAFIA RETROGRADA E LA PAPILLOTOMIA ENDOSCOPICA NELL' OPERATO SULLE VIE BILIARI
(LA CHOLANGIOGRAPHIE RETROGRADE ET LA PAPILLOTOMIE ENDOSCOPIQUE CHEZ LE MALADE SOUMIS A UNE INTERVENTION SUR LES VOIES BILIAIRES)
VICECONTE G; **CIPOLLA E** ; VICECONTE G W; BOGLIOLO G; FRANCESCHINI R
UNIV. STUDI ROMA IST. III CLIN. CHIR., ROMA,ITALY
Journal: ANN. ITAL. CHIR., 1978, 50 (1-6) 215-236
Language: ITALIAN

VICECONTE G; **CIPOLLA E** ; VICECONTE G W; BOGLIOLO G; FRANCESCHINI R
?